



## GALL MAKERS (CECIDOMYIIDAE, DIPTERA) ON *CALOPHYLLUM BRASILIENSE* CAMB. (CLUSIACEAE): DESCRIPTIONS AND BIOLOGY<sup>(1)</sup>

(With 82 figures)

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**ABSTRACT:** Five new species of gall makers (Cecidomyiidae, Diptera) associated with *Calophyllum brasiliense* (Clusiaceae) are described and illustrated from Carapebus, State of Rio de Janeiro, Brazil: *Lopesia caulinaris*, *L. conspicua*, *L. elliptica*, *L. linearis* and *Contarinia gemmae*. Some biological and ecological data are given.

**Key words:** Cecidomyiidae, Diptera, gall, *Calophyllum brasiliense*, Clusiaceae, restinga.

**RESUMO:** Galhadores (Cecidomyiidae, Diptera) em *Calophyllum brasiliense* (Clusiaceae): descrições e biologia. Cinco espécies novas galhadoras (Cecidomyiidae, Diptera) associadas com *Calophyllum brasiliense* (Clusiaceae) são descritas e ilustradas de Carapebus, Estado do Rio de Janeiro, Brasil: *Lopesia caulinaris*, *L. conspicua*, *L. elliptica*, *L. linearis* and *Contarinia gemmae*. Algumas informações biológicas e ecológicas são fornecidas.

**Palavras-chave:** Cecidomyiidae, Diptera, galha, *Calophyllum brasiliense*, Clusiaceae, restinga.

### INTRODUCTION

The Cecidomyiidae is one of the richest family of the Diptera, especially in the neotropics. Nevertheless, the proportion of species new to science is so large that one cannot estimate reasonably their whole richness (GAGNÉ, 1994). There is an urgent demand for new descriptions of species, and even genera, to improve our knowledge on the family. Here five new species that constitute a complex that uses *Calophyllum brasiliense* Camb. (Clusiaceae) as host are described.

This study was part of an effort to enhance the knowledge about galling insects of the Atlantic Forest region, with emphasis in the *restinga* coastal sand plain formation within Atlantic Forest biome vegetation in Brazil (MONTEIRO *et al.*, 1994; MAIA, 2001a, MAIA, 2001b).

*Calophyllum brasiliense* is a widely distributed tree that occurs from Central America to north of Santa Catarina state, southern Brazil. It always occurs associated with forests subjected to flooding or high moisture, as in the Amazonian or Atlantic Forest, or gallery forests in Cerrado (Brazilian savanna) (MARQUES & JOLY, 2000).

In a recent list of known neotropical gallers (GAGNÉ, 1994), there is no mention of any species using *C. brasiliense* as host. The only previous record on this species of plant was in RIBEIRO *et al.* (1998), that studied the pattern of abundance distribution of one of the gallers described here. This is, therefore, the first record of these gallers, that belong to the genera *Lopesia* Rübсаamen, 1908 (4 new species) and *Contarinia* Rondani, 1860 (one new species).

*Lopesia* is known from 8 described species (3 from Africa, 1 from North America and 4 from South America) and *Contarinia*, a cosmopolitan and catchall genus, includes about 300 species, being 5 neotropical. Although only one species has been described from Brazil (GAGNÉ *et al.*, 2001), some unnamed species have also been recorded (*e.g.*, FERNANDES, 1998; MAIA, 2001b). In addition to the descriptions of the new species, we still include some basic data about the biology and ecology of the gallers.

### MATERIAL AND METHODS

This work was part of a study on the galling species of *C. brasiliense* in a periodically flooded

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*restinga* forest at Parque Nacional da Restinga de Jurubatiba, Rio de Janeiro state, Brazil (22°00'-22°23'S, 41°15'-41°45'W). Plants were surveyed monthly during 18 months. We measured the number of galls per leaf and recorded the periods of galls occurrence.

In all occasions, branches containing leaves with mature galls were collected and taken to the laboratory for rearing of adults and immature of the inducers. The branches were stored in plastic bags with wet paper to avoid desiccation, and observed throughout a month. From this material, we obtained larvae, pupae, pupal exuviae and adult midges. All were first conserved in 70% alcohol. The specimens were mounted on slides following the methodology described in GAGNÉ, 1994. The holotypes and additional specimens are deposited in the Museu Nacional - Rio de Janeiro (MNRJ).

Galls induced by each species were drawn using representative gall individuals as models. From this material, we also obtained a sex ratio for each species.

The field and laboratory work was done by João A. Madeira and Ricardo F. Monteiro, while the taxonomy and descriptions of the new species were made by Valéria C. Maia.

Abbreviations used: (emg.) emergence, (fix.) fixation.

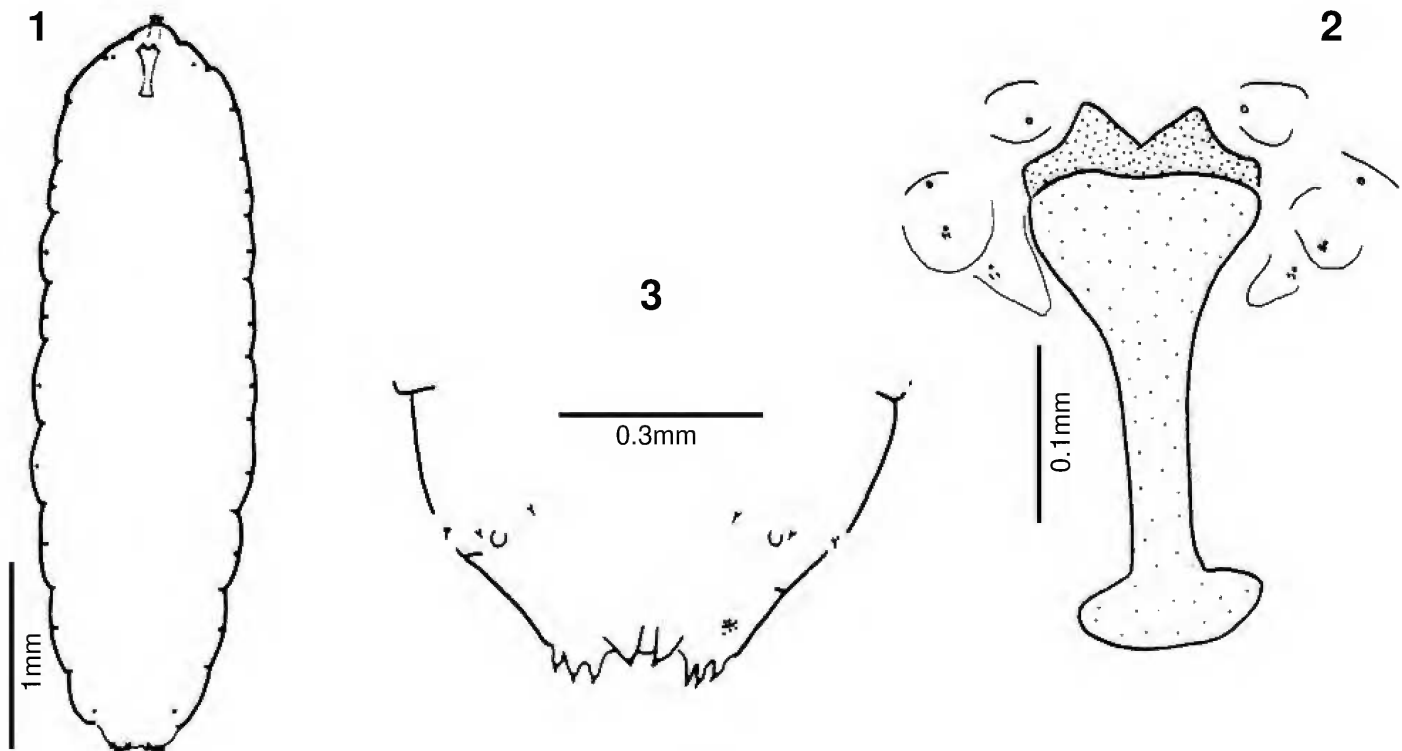
## RESULTS

### Descriptions of galls and gall makers

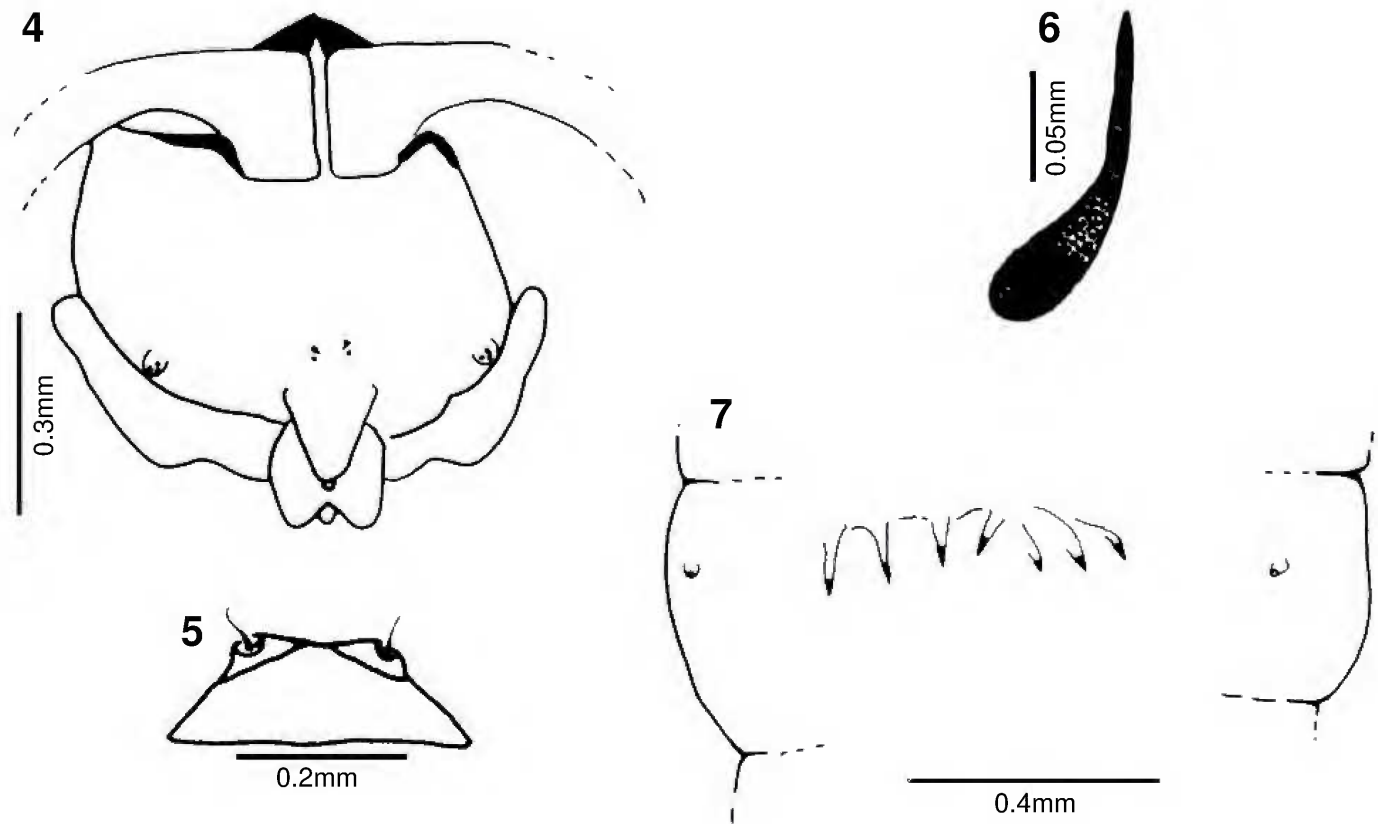
#### *Lopesia caulinaris* Maia, sp.nov. (Figs.1-17b)

Larva (Fig.1) – Body length: 3.9mm (N=1). Color: yellow. Spatula 2-toothed; length: 0.28mm (N=1); full complement of lateral papillae (Fig.2). Four pairs of setose terminal papillae subequal in length (Fig.3).

Pupa – Length: 3.6-4.2mm (N=5). Cephalic region (Fig.4): Antennal horn simple, triangular and very short with 0.02mm of length (N=5); full complement of lower and lateral papillae; upper cephalic margin thickened laterally; cephalic seta with 0.06-0.08mm of length (N=5) (Fig.5). Thorax: Prothoracic spiracle well developed, elongate, setiform (length: 0.25-0.28mm) (Fig.6). Wing sheath reaching  $\frac{1}{3}$  distal of abdominal segment 3; fore leg reaching distal margin of abdominal segment 5; mid leg reaching  $\frac{1}{5}$  basal of abdominal segment 6; hind leg reaching  $\frac{1}{3}$  basal of abdominal segment 6. Abdomen (Fig.7): Tergites 2-8 with a single row of dorsal spines. Segment 2 with 11-12



*Lopesia caulinaris* Maia, sp.nov., larva: fig.1- general aspect (dorsal); fig.2- spatula prothoracic and associated papillae (ventral); fig.3- terminal segments (dorsal).

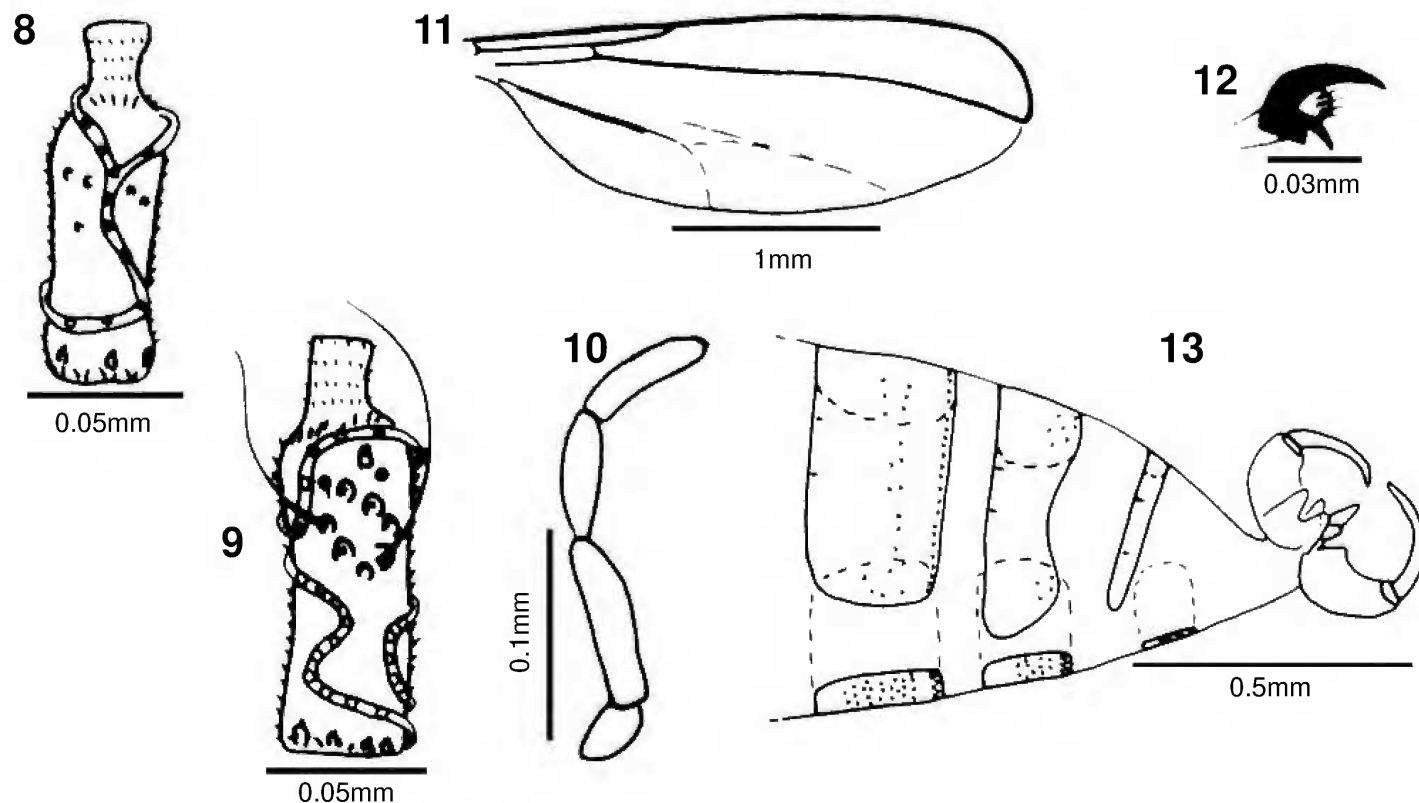


*Lopsia caulinaris* Maia, sp.nov., pupa: fig.4- cephalic region (ventral); fig.5- cephalic setae (dorsal); fig.6- prothoracic spiracle (dorsal); fig.7- abdominal segment VII (dorsal).

conspicuous spines; segment 3: 11-12; segment 4: 10-12; segment 5: 10; segment 6: 8-11; segment 7: 8-9; segment 8: 6-8.

Adult – Length: 3.0-4.1mm (N=5). Head. Eye facets hexagonal; postvertical peak present. Antenna: male flagellomeres cylindrical, gynecoid with circumfila anastomosing (Fig.8); female flagellomeres cylindrical with circumfila anastomosing (Fig.9); flagellomeres 1 and 2 connate, flagellomere necks setulose and twelfth flagellomere with apical process in both sexes. Frontoclypeus with 8 setae. Labrum triangular, long-attenuate, with 2 pairs of ventral sensory setae and long, anteriorly directed lateral setulae. Hypopharynx of the same shape as labrum with long, anteriorly directed lateral setulae. Labella elongate, each with 8 long setae and 2 short mesal sensory setae. Palpus: all segments cylindrical, the first the shortest; the second the longest; the third and the fourth subequal in length and narrower than the preceding ones (Fig.10). Thorax. Wing (Fig.11): length: 2.6-3.1mm (N=5). Anepisternum bare. Anepimeron with vertical irregular row of 10 setae. Tarsal claws bent at basal third, toothed on all legs;

empodia reaching to bend in claws (Fig.12). Abdomen. Male (Fig.13): tergites 1-6 sclerotized, rectangular with mostly single, continuous, posterior row of setae, several lateral setae on each side near midlength, scales covering most of sclerites and a pair of trichoid sensilla on anterior margin. Tergite 7 sclerotized, with a medial reentrance in posterior margin, few lateral setae and a pair of trichoid sensilla on anterior margin; tergite 8 sclerotized band like with a pair of trichoid sensilla for vestiture. Sternites 2-8 rectangular and setose, setae more abundant basally and mesally. Female (Fig.14): tergites 1-7 as for 1-6 in male; sternites 2-7 as for 2-7 in male, tergite 8 with a basal pair of trichoid sensilla and subdivided into two sclerotized plates, each one with a trichoid sensilla. Sternite 8 quadrate and setose, setae more abundant basally and mesally. Sternite 9 with scattered setae. Male terminalia (Fig.15): gonocoxites splayed with a conspicuous spiny mesobasal lobe; gonostylus elongate, narrow, almost regular in width and slightly bent beyond midlength; cercus rounded and setose; hypoproct bilobed (lobes wide); parameres absent; aedeagus



*Lopesia caulinaris* Maia, sp.nov.: fig.8- male flagellomere V; fig.9- female flagellomere V; fig.10- ♂, palpus; fig.11- ♂, wing; fig.12- ♂, tarsal claw and empodium, midleg; fig.13- ♂, abdominal segments 6 to the end (lateral).

elongate and tapering gradually to apex. Ovipositor barely protrusible, female cerci separate, wide and very setose (Fig.16).

Material (MNRJ) – Holotype ♂, BRAZIL, RIO DE JANEIRO: Carapebus, 04/VII/2000, J.Madeira col. Paratypes: 2♂ (same locality, date and collector as holotype); 1♂, 05/IV/2000; 1♂, 23/XI/2000; 1♀, 06/VI/2000; 1♀, 29/XII/2000; 4♀ 20/I/2001; 2 pupal exuviae, 23/XI/2000; 1 pupal exuviae, 29/XII/2000, 2 pupal exuviae, 20/I/2001; 1 larva, 01/VIII/2001 (same locality and collector as holotype).

Gall (Fig.17a, b) – One-chambered stem gall that forms a swelling on the growing stem, which usually do not totally surround the stem, except when more than one gall grow close together and merge into a single larger structure, that often kills the branch, inducing plant ramification.

A single larva usually develops in the chamber, but we rarely found two or three larvae in the same chamber.

Adults were obtained from galls collected on May, June, July, August and December. This species was observed attacking plants of all heights, except those shorter than 1.3m.

Etymology – The name *caulinaris* refers to the gall placement on the host plant organ.

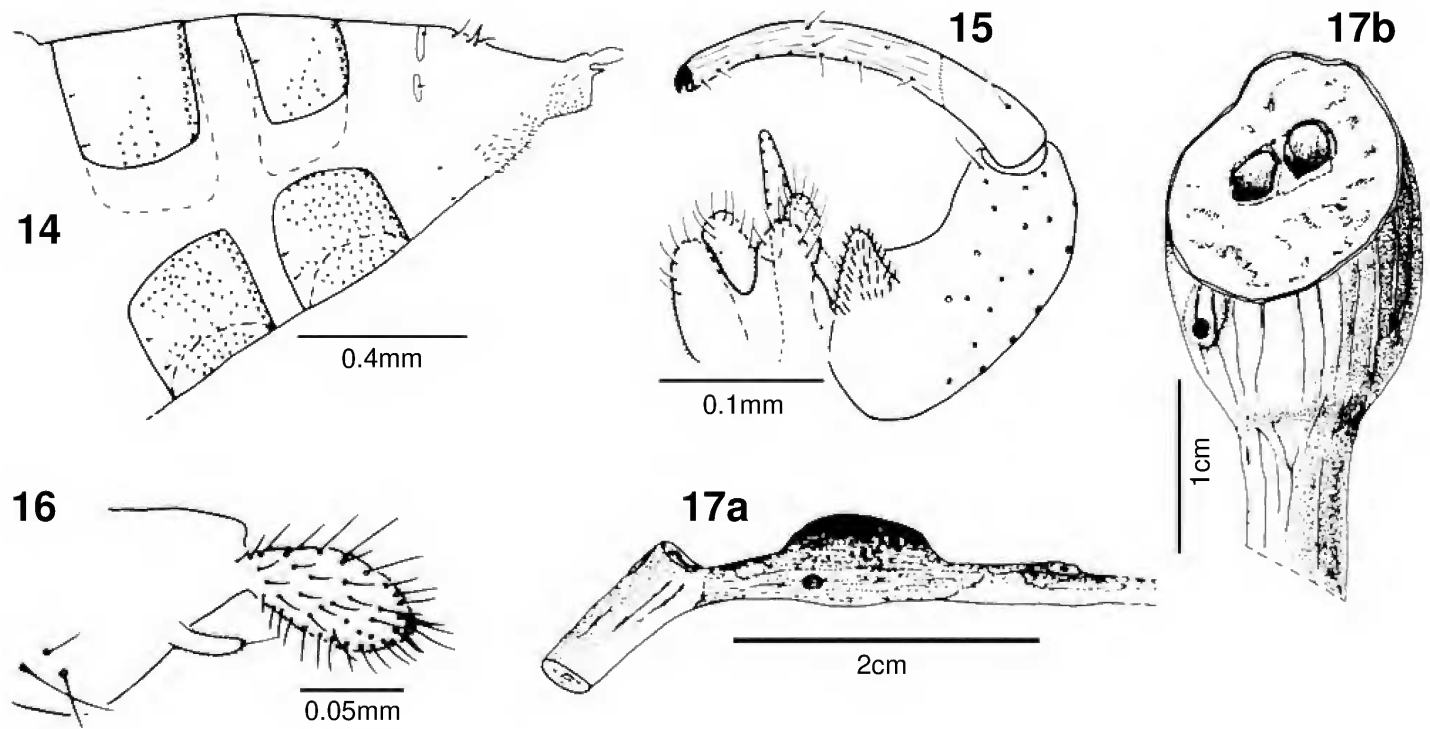
Remarks – This species is unique due to spiny mesobasal lobes (in male) and tergite 8 subdivided into two plates (in female).

*Lopesia conspicua* Maia, sp.nov.  
(Figs.18-34b)

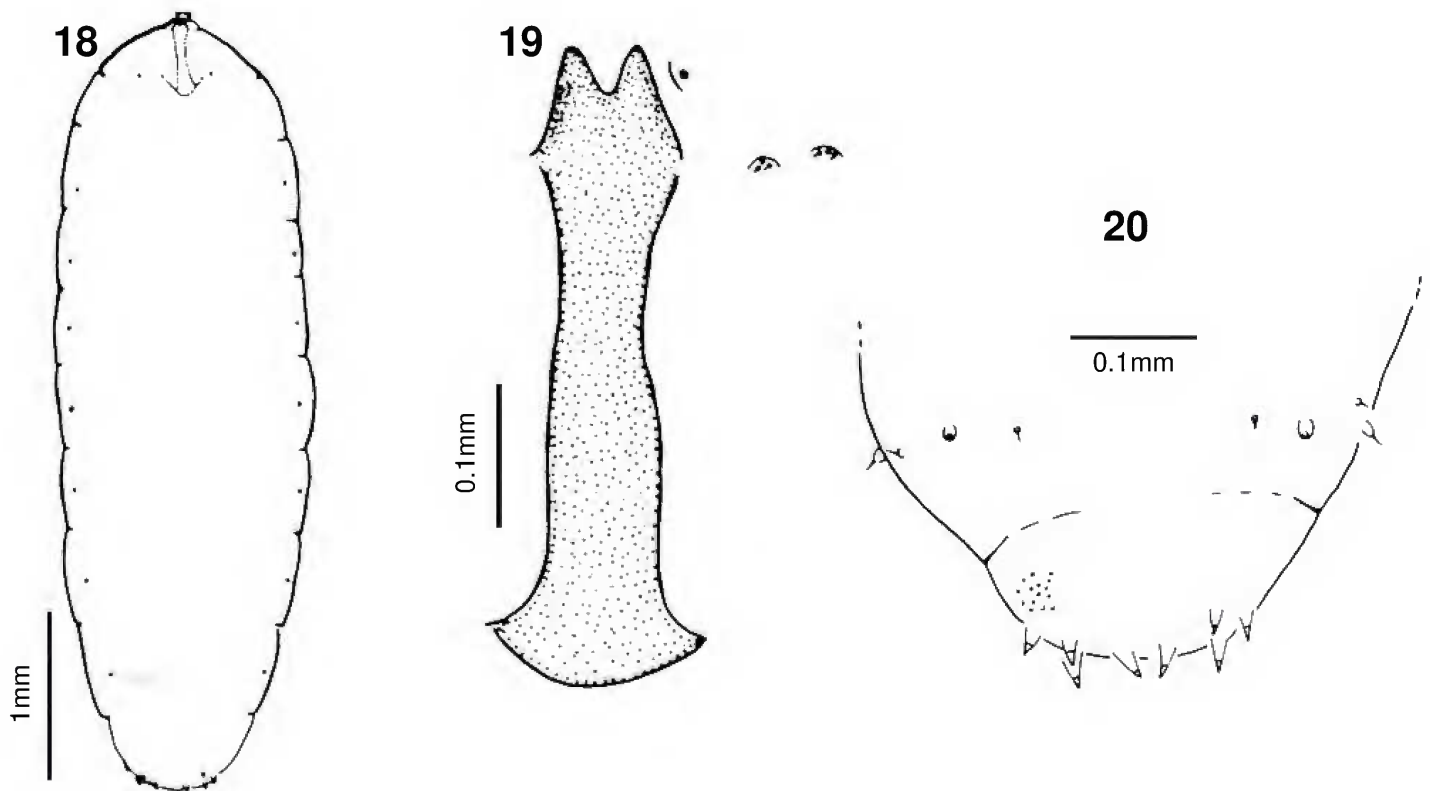
Larva (Fig.18) – Body length: 2.6-4.8mm (N=5). Color: yellow. Spatula 2-toothed; length: 0.25-0.45mm (N=5); full complement of lateral papillae (Fig.19). Four pairs of setose terminal papillae subequal in length (Fig.20).

Pupa – Length: 4.0-5.2mm (N=5). Cephalic region (Fig.21): Antennal horn simple, pointed to apex and with 0.06-0.09mm of length (N=5); full complement of lower and lateral papillae; upper cephalic margin thickened laterally; cephalic seta with 0.06-0.08mm of length (N=5) (Fig.22). Thorax: Prothoracic spiracle well developed, elongate, widest at base (length: 0.18-0.25mm; (N=5) (Fig.23). Wing sheath reaching  $\frac{1}{3}$  basal of the abdominal segment 3; fore and midleg subequal in length, reaching the distal margin of the abdominal segment 5; hind leg reaching  $\frac{2}{3}$

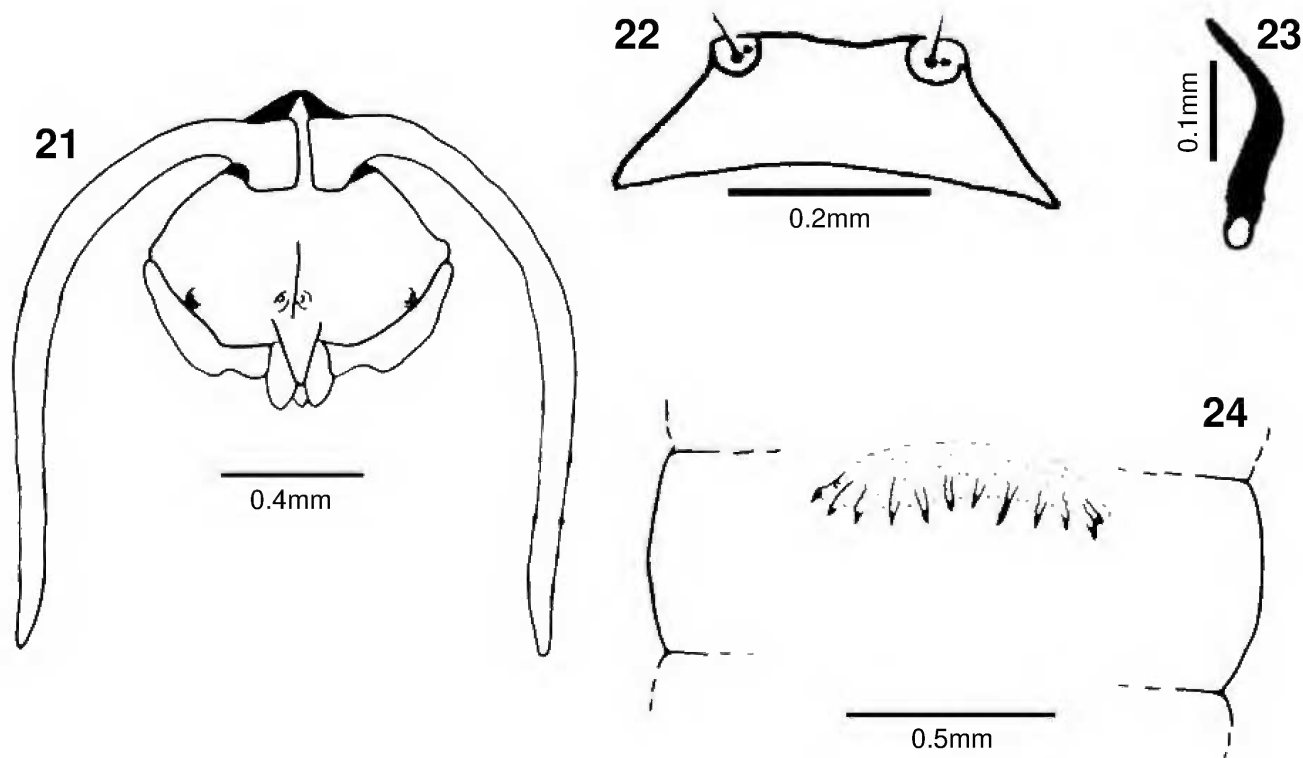




*Lopesia caulinaris* Maia, sp.nov.: fig.14- ♀ , abdominal segments 6 to the end (lateral); fig.15- male terminalia (dorsal); fig.16- ♀ , ovipositor (lateral); fig.17a- gall, general aspect; fig.17b- gall, transversal section.



*Lopesia conspicua* Maia, sp.nov., larva: fig.18- general aspect (dorsal); fig.19- spatula prothoracic and associated papillae (ventral); fig.20- terminal segments (dorsal).



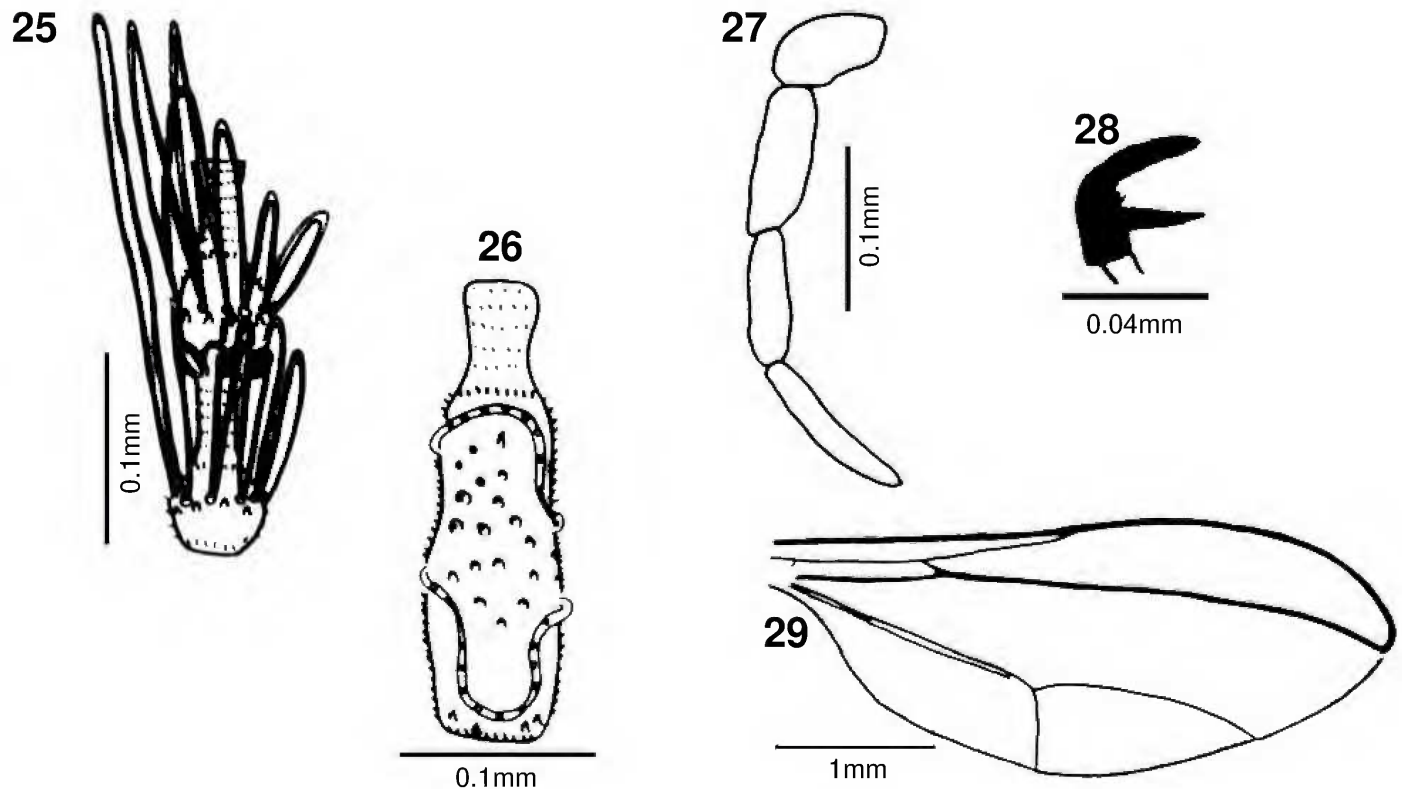
*Lopesia conspicua* Maia, sp.nov., pupa: fig.21- cephalic region (ventral); fig.22- cephalic setae (dorsal); fig.23- prothoracic spiracle (dorsal); fig.24- abdominal segment V (dorsal).

of the abdominal segment 5. Abdomen (Fig.24): Tergites 2-8 with a single row of dorsal spines. Segments 2 and 3 with 11-17 well developed spines; segment 4 with 12-16 well developed spines; segment 5: 11-14; segment 6: 9-11; segment 7: 6-10 and segment 8: 4-6.

Adult – Length: 4.0-5.0mm (N=5). Head. Eyes facets hexagonal; male flagellomeres: binodal and tricircumfilar; circumfila 1 and 3 with loops irregular in length, circumfila 2 with shorter loops (Fig.25). Female flagellomeres with anastomosing circumfila (Fig.26). Flagellomere necks setulose in both sexes. Twelfth flagellomere with apical process in both sexes. Frontoclypeus with 8-10 setae. Labrum triangular, long-attenuate, with 2 pairs of ventral sensory setae and long, anteriorly directed lateral setulae. Hypopharynx of the same shape as labrum with long, anteriorly directed lateral setulae. Labella elongate, each with 8-10 long setae and 2 short mesal sensory setae. Palpus: all segments cylindrical, the first the shortest, the third the widest, the fourth the longest; segments 2 and 3 subequal in length (Fig.27). Thorax. Wing (Fig.28): length: 3.1-4.1mm (N=5). Anepisternum with few scales

near middle. Anepimeron with vertical irregular row of 12-19 setae. Tarsal claws bent at basal third, toothed on all legs; empodia reaching to bend in claws (Fig.29).

Abdomen – Male (Fig.30): tergites 1-6 rectangular with mostly single, continuous, posterior row of setae, several lateral setae on each side near midlength, scales covering most of sclerites and pair of trichoid sensilla on anterior margin. Tergite 7 partially sclerotized on posterior margin, with few lateral setae and pair of trichoid sensilla on anterior margin. Tergite 8 (male) little sclerotized band like with pair of trichoid sensilla for vestiture. Sternites 2-7 rectangular and setose, setae more abundant basally and mesaly. Sternite 8 almost square with caudal and midlength rows of setae and pair of trichoid sensilla on anterior margin. Female (Fig.31): tergites 1-7 as for 1-6 in male; sternites 2-7 as for 2-6 in male, tergite 8 unsclerotized with basal pair of trichoid sensilla. Sternite 9 with scattered setae. Male terminalia (Fig.32): gonocoxites splayed with a conspicuous mesobasal lobe; gonostylus elongate, narrow, regular in length and bent at distal  $\frac{1}{3}$ ; cercus rounded and hypoproct bilobed; parameres absent; aedeagus



*Lopesia conspicua* Maia, sp.nov.: fig.25- male flagellomere VI; fig.26- female flagellomere V; fig.27- ♂, palpus; fig.28- ♀, wing; fig.29- ♀, tarsal claw and empodium, midleg.

elongate and tapering gradually to apex. Ovipositor barely protrusible, female cerci separate, wide and very setose (Fig.33).

Material (MNRJ) – Holotype ♂, BRAZIL, RIO DE JANEIRO: Carapebus, 29/XII/2000, emg. 08/I/2001, J.Madeira col. Paratypes: 1♂, emg. 08/I/2001; 2♂, emg. 09/I/2001; 5♂, emg. 11/I/2001; 2♀, emg. 08/I/2001; 2♀, emg. 09/I/2001; 4♀, emg. 11/I/2001; 1♀, emg. 17/I/2001; 4 pupal exuviae, emg. 08/I/2001; 7 pupal exuviae, emg. 09/I/2001; 17 pupal exuviae, emg.11/I/2001; 10 pupal exuviae, emg. 17/I/2001; 1 larva (same locality, date and collector as holotype).

Gall (Fig.34a, b) – Spheroid swelling with 5-10mm diameter, usually with a major portion facing down, but also apparent on adaxial leaf face. A single chamber develops, positioned transversally to leaf lamina, surrounded by a very rigid tissue. The single larva pupates in the gall and the pupa emerges from an opening on the abaxial end of the chamber. Galls occur mainly along the main vein and eventually on leaf edge. 89% of the galled leaves observed bore one to five galls. When two or more galls develop close to each other, they merge in a single structure. This species showed a whole year life

cycle, with larvae of third instar remaining most of the time in diapause. Adults were obtained only in December and January, in close synchrony with trees' leaf flush, and were found almost exclusively on trees (J.A.Madeira, unpublished data).

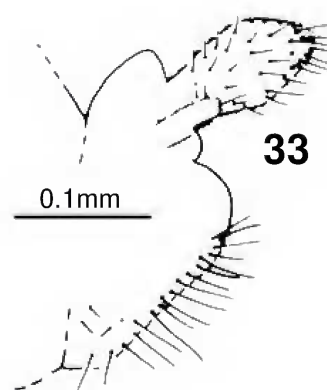
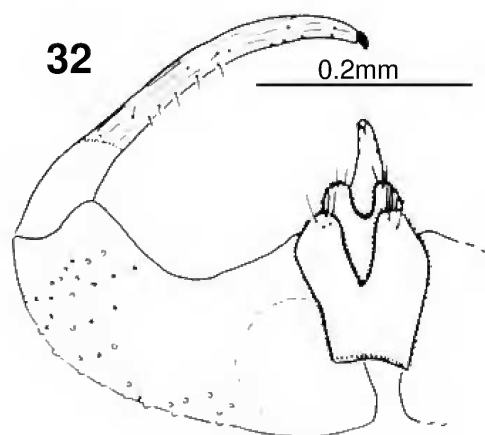
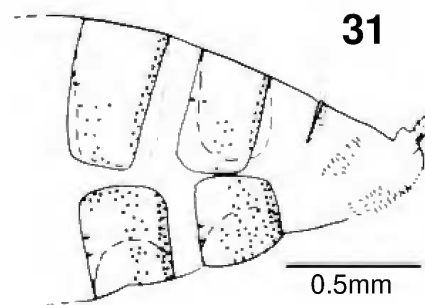
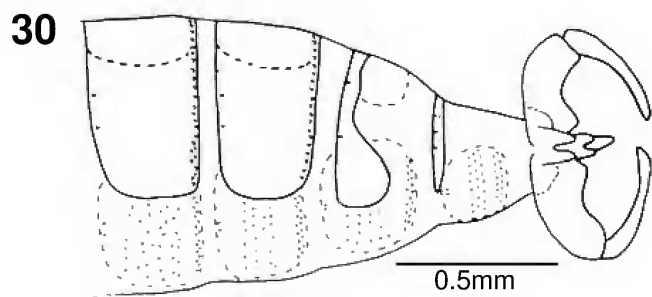
Etymology – The name *conspicua* refers to the gall conspicuousness.

Remarks – This species differs from the other known *Lopesia* in having the male tergite 7 partially sclerotized without the common caudal row of setae.

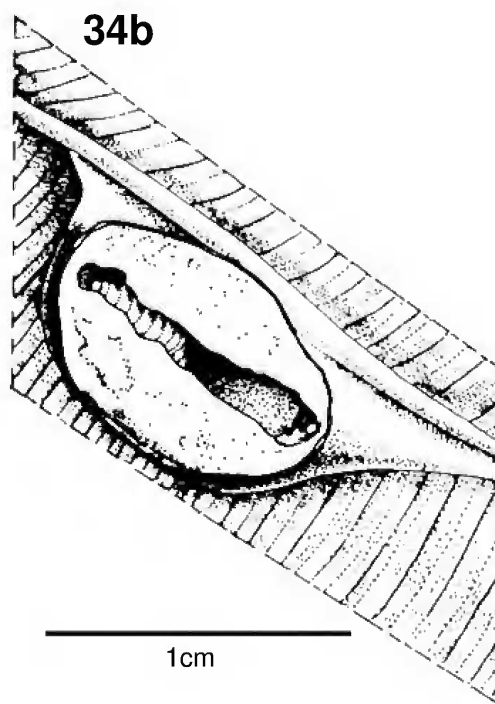
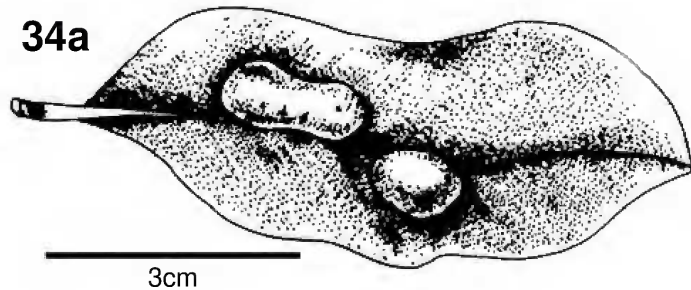
*Lopesia elliptica* Maia, sp.nov.  
(Figs.35-51b)

Larva (Fig.35): Body length: 4.0-4.5mm (N=6). Color: yellow. Spatula 2-toothed; length: 0.30-0.33mm (N=6); full complement of lateral papillae (Fig.36). Four pairs of setose terminal papillae subequal in length (Fig.37).

Pupa – Length: 3.2-4.2mm (N=4). Cephalic region (Fig.38): Antennal horn simple, triangular, with 0.04-0.05mm of length (N=4); full complement of lower and lateral papillae; upper cephalic margin thickened laterally;

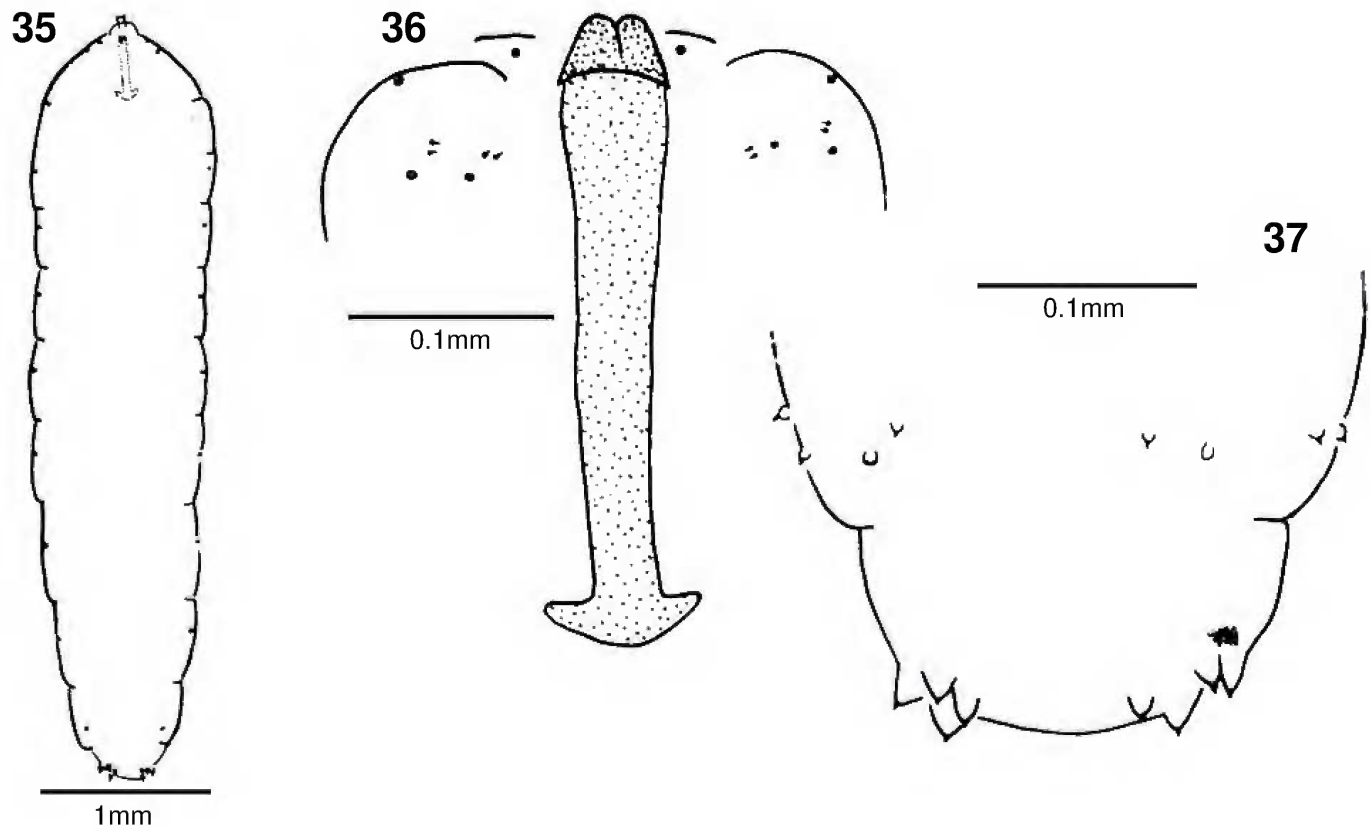


*Lopesia conspicua* Maia, sp.nov.: fig.30-♂, abdominal segment 5 to the end (lateral); fig.31-♀, abdominal segments 5 to the end (lateral); fig.32- male terminalia (dorsal); fig.33-♀, ovipositor (lateral).



*Lopesia conspicua* Maia, sp.nov., gall: fig.34a- general aspect; fig.34b- transversal section.





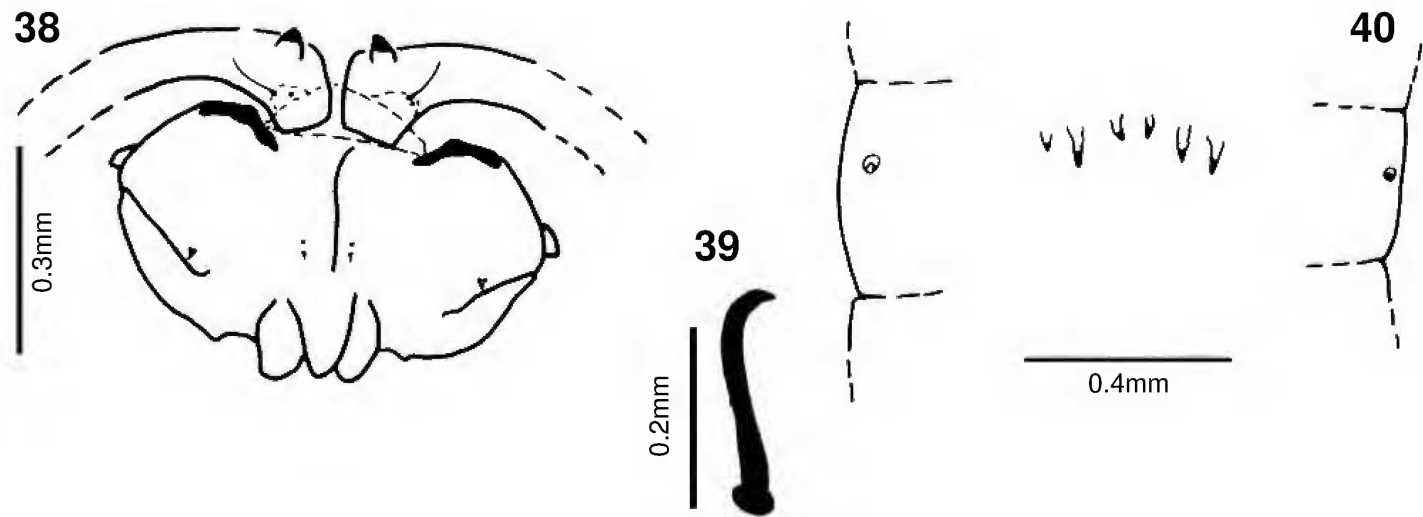
*Lopesia elliptica* Maia, sp.nov., larva: fig.35- general aspect (dorsal); fig.36- spatula prothoracic and associated papillae (ventral); fig.37- terminal segments (dorsal).

cephalic seta with 0.07-0.08mm of length (N=4). Thorax: Prothoracic spiracle well developed, elongate, setiform (length: 0.25-0.28mm) (Fig.39). Wing sheath reaching  $\frac{1}{3}$  basal of the abdominal segment 3; fore leg reaching  $\frac{1}{3}$  distal of the abdominal segment 5; mid leg ending near the distal margin of the abdominal segment 5; hind leg reaching  $\frac{1}{35}$  basal of the abdominal segment 6. Abdomen (Fig.40): Tergites 2-8 with a single row of dorsal spines. Segment 2 with 7-12 spines; segment 3 with 7-9; segment 4: 6-7; segment 5: 5-7; segment 6: 4-6; segment 7: 5-7 and segment 8: 4-9.

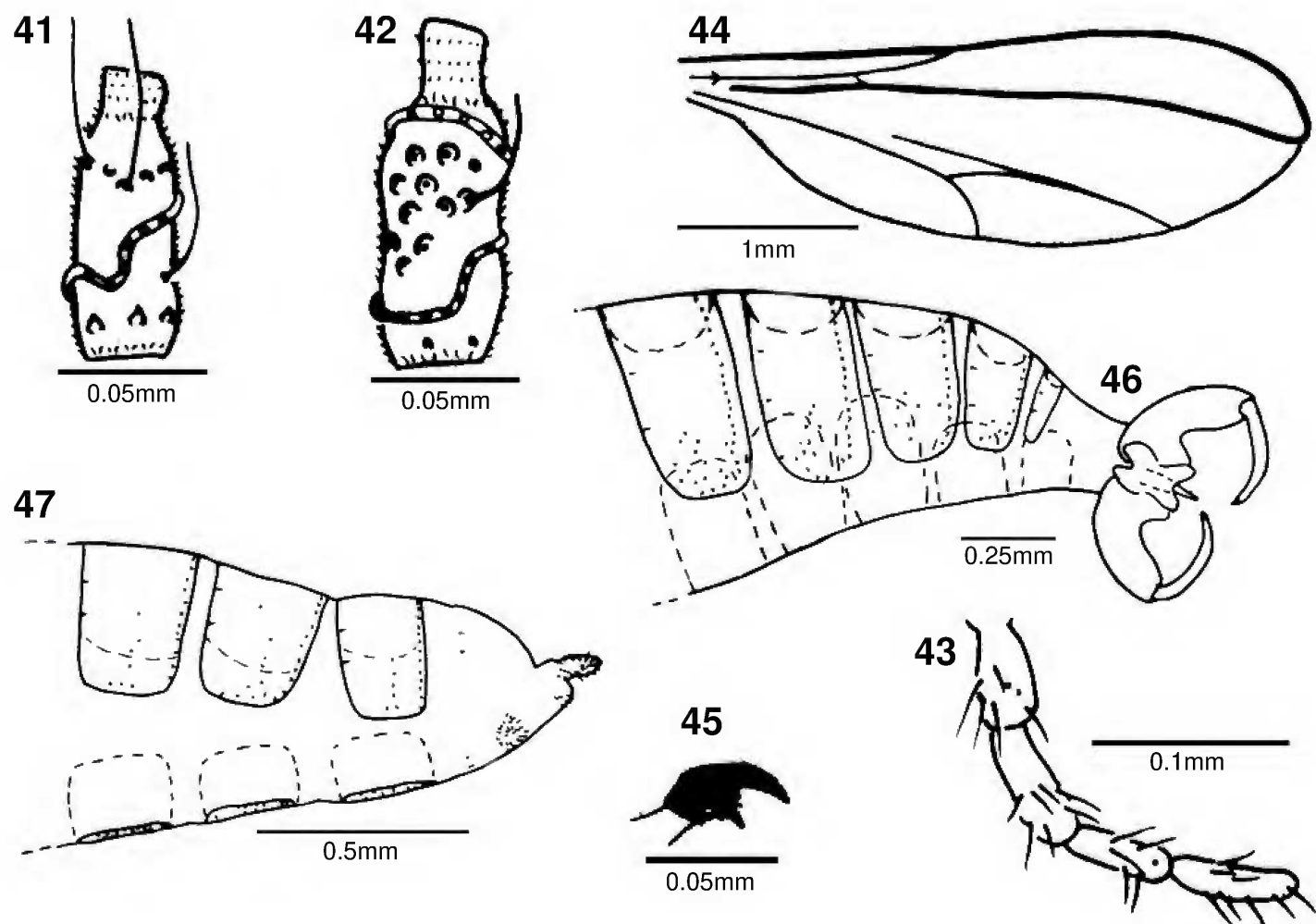
Adult - Length: 3.0-5.0mm (N=5). Head. Eyes facets hexagonal; male flagellomeres cylindrical, gynecoid, circumfila as in figure 41. Female flagellomeres cylindrical, circumfila as in figure 42. Flagellomere 1 and 2 fused, flagellomere necks setulose and twelfth flagellomere with apical process in both sexes. Frontoclypeus with 8 setae. Labrum triangular, long-attenuate, with 2 pairs of ventral sensory setae and long, anteriorly directed lateral setulae. Hypopharynx of the same shape as labrum

with long, anteriorly directed lateral setulae. Labella elongate, each with 6 long setae and 2 short mesal sensory setae. Palpus: all segments cylindrical, the first and the third subequal in length; the second and the fourth slightly longer and subequal in length (Fig.43). Thorax. Wing (Fig.44): length: 2.6-3.3mm (N=4). Anepisternum bare. Anepimeron with vertical irregular row of 12-15 setae. Tarsal claws bent at basal third, toothed on all legs; empodia reaching to bend in claws (Fig.45).

Abdomen - Male (Fig.46): tergites 1-7 rectangular with single, continuous, posterior row of caudal setae, several lateral setae on each side near midlength, scales covering most of sclerites and pair of trichoid sensilla on anterior margin. Tergite 8 sclerotized band like with pair of trichoid sensilla for vestiture. Sternites 2-8 rectangular and setose, setae more abundant basally and mesaly. Female (Fig.47): tergites 1-7 as for 1-7 in male; sternites 2-7 as for 2-7 in male, tergite 8 unsclerotized with a basal pair of trichoid sensilla and few setae. Sternite 9 with scattered setae. Male terminalia (Fig.48): gonocoxites



*Lopesia elliptica* Maia, sp.nov., pupa: fig.38- cephalic region (ventral); fig.39- prothoracic spiracle (dorsal); fig.40- abdominal segment IV (dorsal).



*Lopesia elliptica* Maia, sp.nov.: fig.41- male flagellomere IV; fig.42- female flagellomere V; fig.43- ♀, palpus; fig.44- ♀, wing; fig.45- ♀, tarsal claw and empodium, foreleg; fig. 46- ♂, abdominal segments 4 to end (lateral); fig.47- ♀, abdominal segments 6 to the end (lateral).

splayed with a conspicuous mesobasal lobe; gonostylus elongate, narrow, slightly narrowest towards apex and slightly bent beyond midlength; cercus rounded and setose; hypoproct bilobed (lobes wide); parameres absent; aedeagus elongate and tapering gradually to apex. Ovipositor barely protrusible, female cerci separate, wide and very setose (Figs.49, 50).

Material (MNRJ) – Holotype ♂, BRAZIL, RIO DE JANEIRO: Carapebus, 09/VII/2000, J.Madeira col. Paratypes: 5♀, 09/VII/1999; 2♀, 21/VII/1999; 1♀, 04/VII/2000; 2 pupal exuviae. 21/VII/1999; 1 pupal exuvia, 04/VII/2000, emg. 19/VII/2000; 1 pupal exuvia, 27/V/2001, fix.: 07/VI/2001; 6 larvae, 01/VIII/2001 (same locality and collector as holotype).

Gall (Fig.51a, b) – Parenchymatic gall that forms a slight, thin walled, elliptical distension of the leaf epidermis, with about 10 and 2mm of major and minor diameters, parallel to secondary veins, on abaxial leaf face. It can also occur parallel to the main vein, close to it, when the gall assumes a half-elliptic form, with the chamber partially occupying a space under the

vein (30.9% of the galls of the species in a 230 leaves sample from 12 trees).

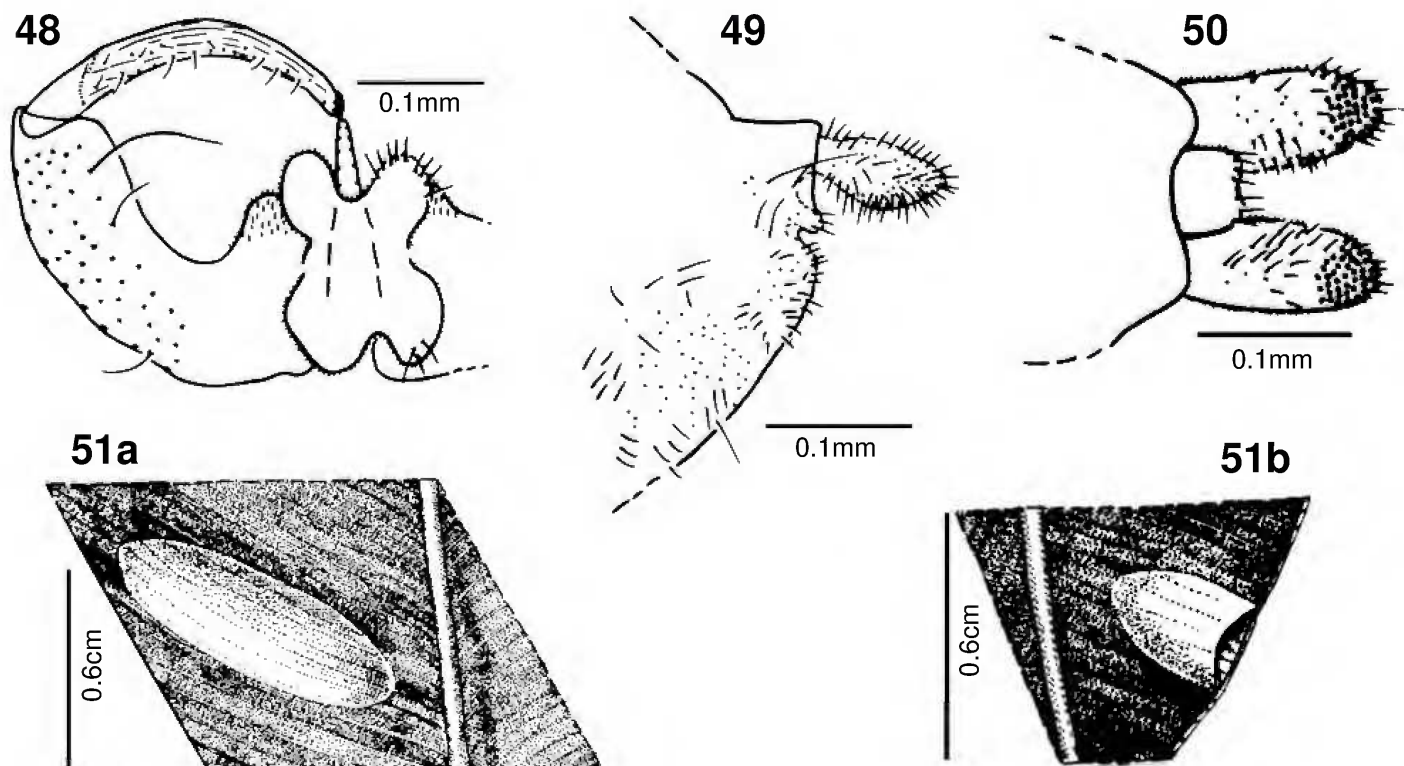
A single larva develops in a single chamber, pupates inside it and the adult emerges from an opening near either the end of the gall on adaxial leaf face. This gall was predominantly found on trees or young plants higher than 2m (J.A.Madeira, unpublished data). All adults were obtained from galls collected in June/July, although new galls appeared between January and March, and between July and September, indicating two cohorts a year.

Etymology – The name *elliptica* refers to the shape of the gall.

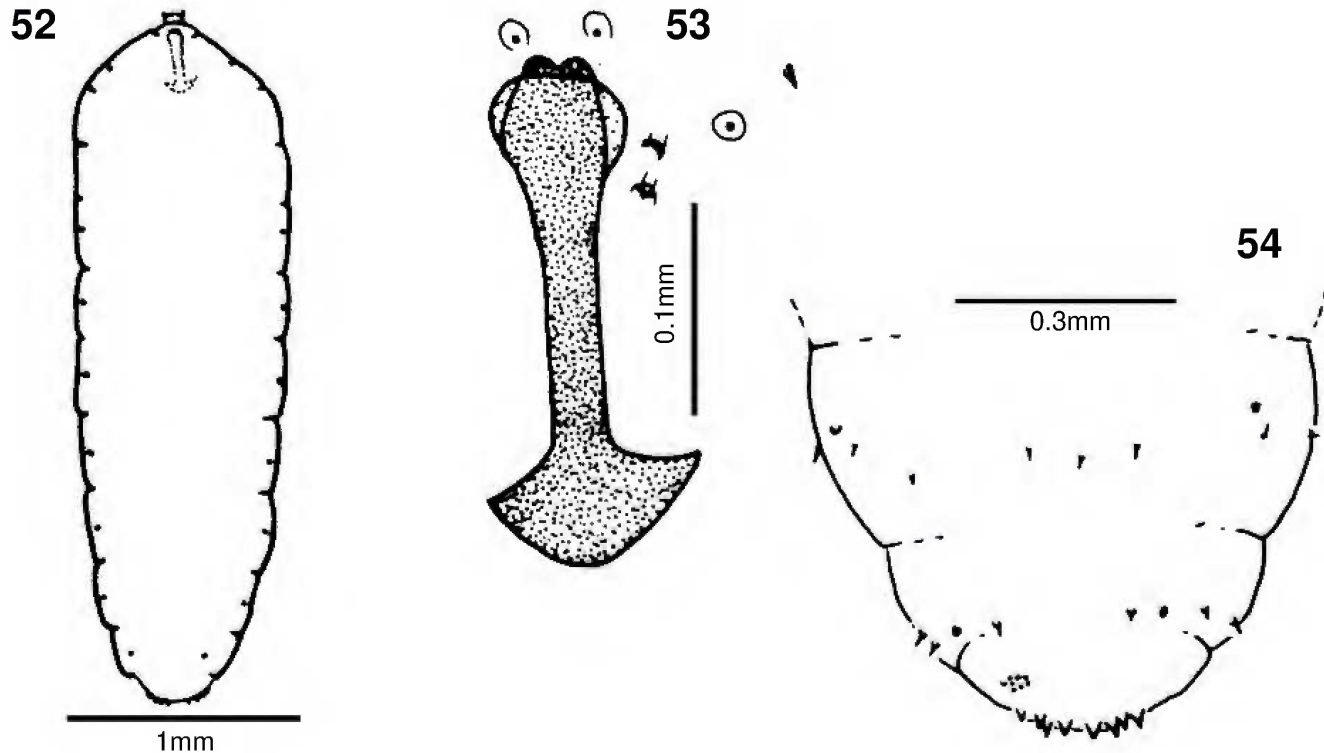
Remarks – This is the only *Lopesia* species with female tergite 8 unsclerotized.

*Lopesia linearis* Maia, sp.nov.  
(Figs.52-67b)

Larva (Fig.52) – Body length: 2.9-3.0mm (N=2). Color: yellow. Spatula 2-toothed; length: 0.26-0.30mm (N=2); full complement of lateral papillae (Fig.53). Four pairs of setose terminal papillae subequal in length (Fig.54).



*Lopesia elliptica* Maia, sp.nov.: fig.48- male terminalia (dorsal); fig.49- ♀, ovipositor (lateral); fig.50- ♀, cerci and hypoproct (ventral); fig.51a- gall, general aspect; fig.51b- gall, transversal section.



*Lopesia linearis* Maia, sp.nov., larva: fig.52- general aspect (dorsal); fig.53- spatula prothoracic and associated papillae (ventral); fig.54- terminal segments (dorsal).

Pupa – Length: 3.2-4.2mm (N=5). Cephalic region (Fig.55): Antennal horn simple, triangular, with 0.06-0.10mm of length (N=5); full complement of lower and lateral papillae; upper cephalic margin thickened laterally; cephalic seta with 0.12-0.13mm of length (N=5). Thorax: Prothoracic spiracle well developed, elongate, setiform (length: 0.12-0.15mm) (Fig.56). Wing sheath reaching  $\frac{1}{3}$  basal to  $\frac{1}{5}$  distal of the abdominal segment 3; fore leg reaching distal limit of  $\frac{2}{3}$  of the abdominal segment 6 or ending sub-distally; mid leg subequal in length or reaching the distal margin of the abdominal segment 6; hind leg reaching  $\frac{1}{5}$  distal of abdominal segment 6 or ending near the proximal margin of the abdominal segment 7. Abdomen (Fig.57): Tergites 3-8 with a single row of dorsal spines. Segment 2 without dorsal spines; segment 3 with 8-12 conspicuous spines; segment 4: 9-11; segment 5: 8-10; segment 6: 7-9; segment 7: 5-9 and segment 8: 4-6.

Adult – Length: 2.5-3.8mm (N=5). Head. Eyes facets hexagonal; male flagellomeres: binodal and tricircumfilar; circumfila 1 and 3 with long loops, circumfila 2 with short loops (Fig.58).

Female flagellomeres with anastomosing circumfila (Fig.59). Flagellomere necks setulose in both sexes. Twelfth flagellomere with apical process in both sexes. Frontoclypeus with 8 setae. Labrum triangular, long-attenuate, with 2 pairs of ventral sensory setae and long, anteriorly directed lateral setulae. Hypopharynx of the same shape as labrum with long, anteriorly directed lateral setulae. Labella elongate, each with 8-10 long setae and 2 short mesal sensory setae. Palpus: all segments cylindrical, the first the shortest; segments 2 and 3 subequal in length; the fourth the longest (Fig.60). Thorax. Wing (Fig.61): length: 2.3-3.0mm (N=5). Anepisternum bare. Anepimeron with vertical irregular row of 09-18 setae. Tarsal claws bent at basal third, toothed on all legs; empodia reaching to bend in claws (Fig.62).

Abdomen – Male (Fig.63): tergites 1-6 rectangular with single, continuous, posterior row of setae, several lateral setae on each side near midlength, scales covering most of sclerites and pair of trichoid sensilla on anterior margin. Tergite 7 rectangular with pair of trichoid sensilla. Tergite 8 (male) sclerotized band like with only basal trichoid sensilla for vestiture.

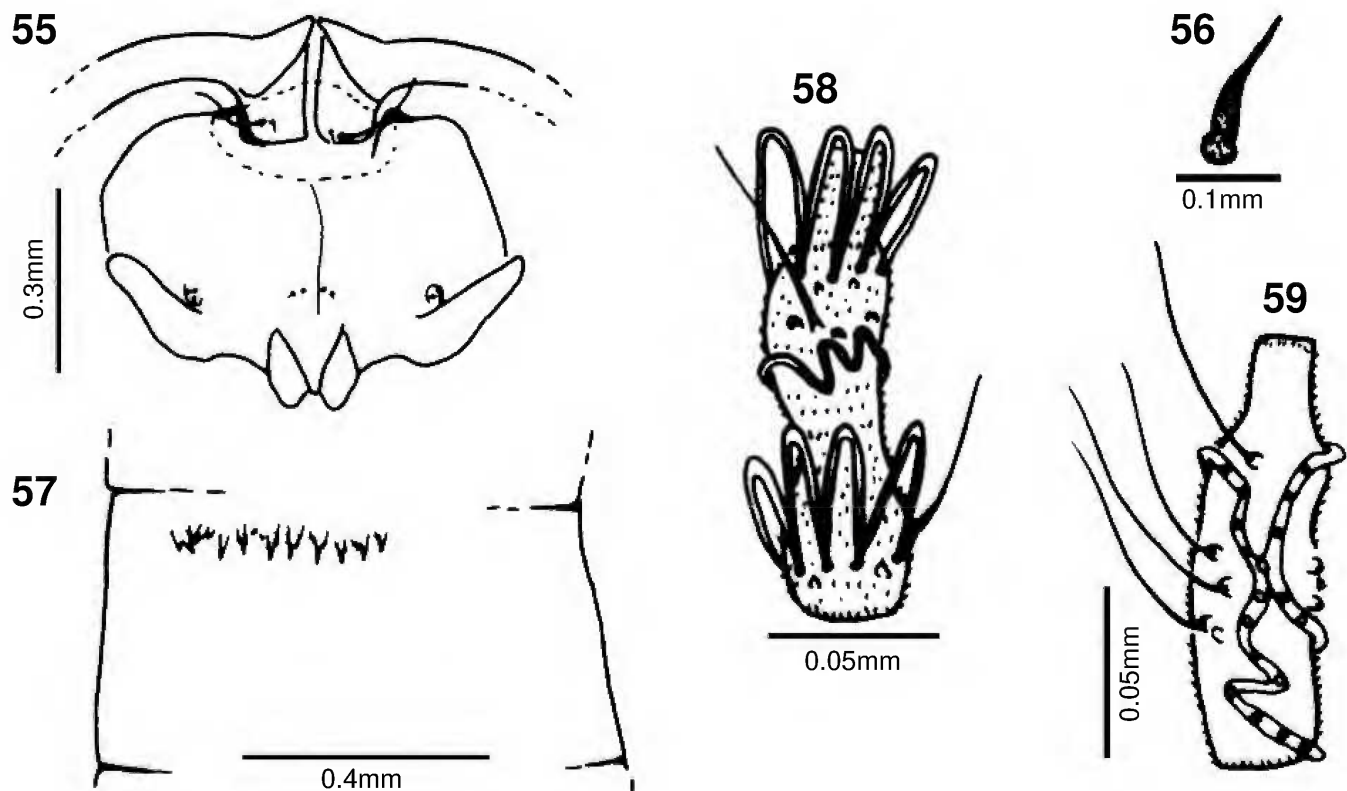


Sternites 2-7 rectangular and setose, setae more abundant basally and mesaly. Sternite 8 almost square with caudal and midlength rows of setae and pair of trichoid sensilla. Female (Fig.64): tergites 1-7 as for 1-6 in male; sternites 2-7 as for 2-6 in male, tergite 8 unsclerotized with pair of trichoid sensilla. Sternite 9 with scattered setae. Male terminalia (Fig.65): gonocoxites not splayed with a small mesobasal lobe; gonostylus elongate, not narrow, slightly narrowest towards apex and slightly bent beyond midlength; cercus rounded and hypoproct bilobed; parameres absent; aedeagus elongate and tapering gradually to apex. Ovipositor barely protrusible, female cerci separate, wide and very setose (Fig.66).

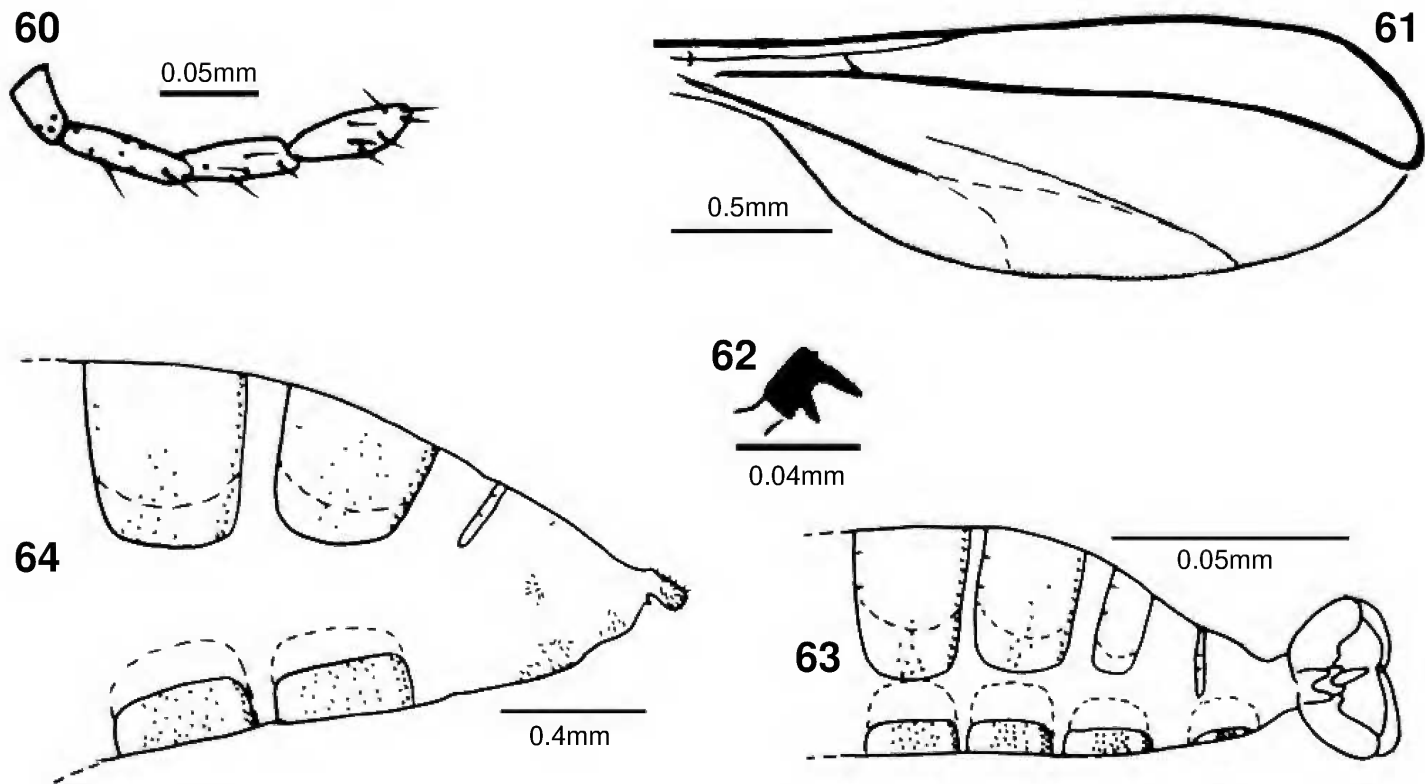
Material (MNRJ) – Holotype ♂ BRAZIL, RIO DE JANEIRO: Carapebus, 04/VII/2000, emg. 19/VII/2001, J.Madeira col.; MNRJ. Paratypes: 1♂; 2♀ emg. 1 on 07/VII/2000 and 1 on 18/VII/2000; 3 pupal exuviae, emg. 1 on 07/VII/2000 and 2 on 19/VII/2000 (same locality, date and collector as holotype); 1♂, 29/XII/2000; 1♀, 2/VII/1999, emg. 11/VIII/1999; 1♀, 29/XII/2000, emg. 09/I/2001; 1♀, 27/VII/2000, emg. 02/VIII/2000; 1♀, 05/VIII/1999; 1 pupal

exuviae, 27/VII/2000; 4 pupal exuviae, 29/XII/2000, emg. 3 on 17/I/2001 and 1 on 09/I/2001; 1 pupal exuviae, 05/VIII/1999; 1 larva, 23/XI/2000, fix. 19/XII/2000; 1 larva, 29/XII/2000, fix. 17/I/2001 (same locality and collector as holotype).

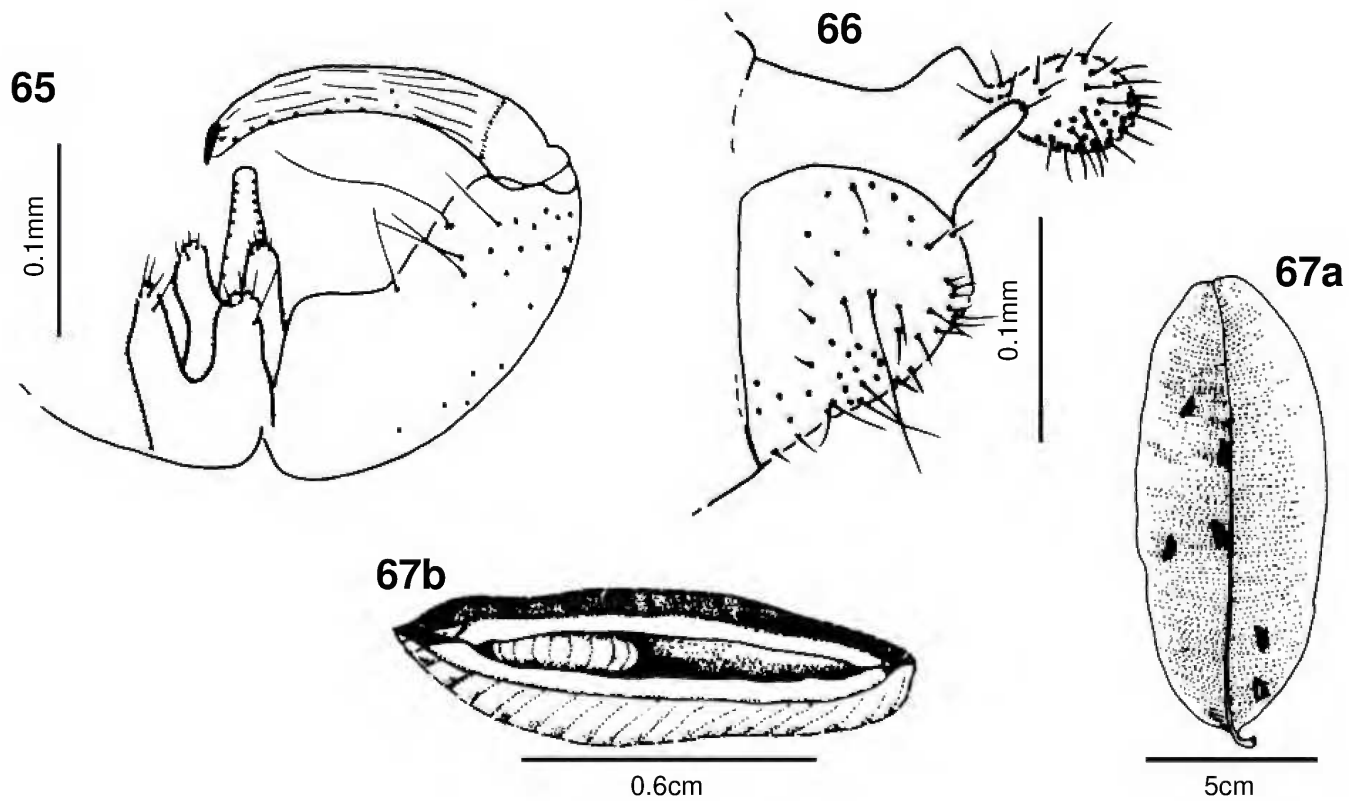
Gall (Fig.67a, b) – Rigid linear swelling (c. 10mm long, 2mm thick), usually on abaxial face, but sometimes on adaxial face also (3.2% of observed galls). The gall originates from a slight furrow produced by female oviposition on very young leaves, crossing secondary veins. A single chamber develops under this furrow, and tissue becomes harder around it, acquiring the aspect of a thin cylinder under the leaf. The single larva pupates in the gall and the pupa emerges from an opening near either the end of the gall, always on the leaf face opposed to that where the gall developed. We found galled leaves bearing from one to more than 100 galls, but more than 90% of the galled leaves bore 15 or less galls. Adults were obtained from galls collected on June/July and November/December; the same periods when new galls appeared in the field. The attack of



*Lopesia linearis* Maia, sp.nov.: fig.55- pupa, cephalic region (ventral); fig.56- pupa, prothoracic spiracle (dorsal); fig.57- pupa, abdominal spines (segment IV) (dorsal); fig.58- male flagellomere IV; fig.59- female flagellomere V.



*Lopesia linearis* Maia, sp.nov.: fig.60- ♂, palpus; fig.61- ♂, wing; fig.62- ♂, tarsal claw and empodium, foreleg; fig.63- ♂, abdominal segments 5 to the end (lateral); fig.64- ♀, abdominal segments 6 to the end (lateral).



*Lopesia linearis* Maia, sp.nov.: fig.65- male terminalia (dorsal); fig.66- ♀, ovipositor (lateral); fig.67a- gall, general aspect; fig.67b- gall, transversal section.

this galler was markedly directed to leaves of young plants (J.A.Madeira, unpublished data).

**Etymology** – The name *linearis* refers to the shape of the gall.

**Remarks** – This species is unique due to the spatula shape.

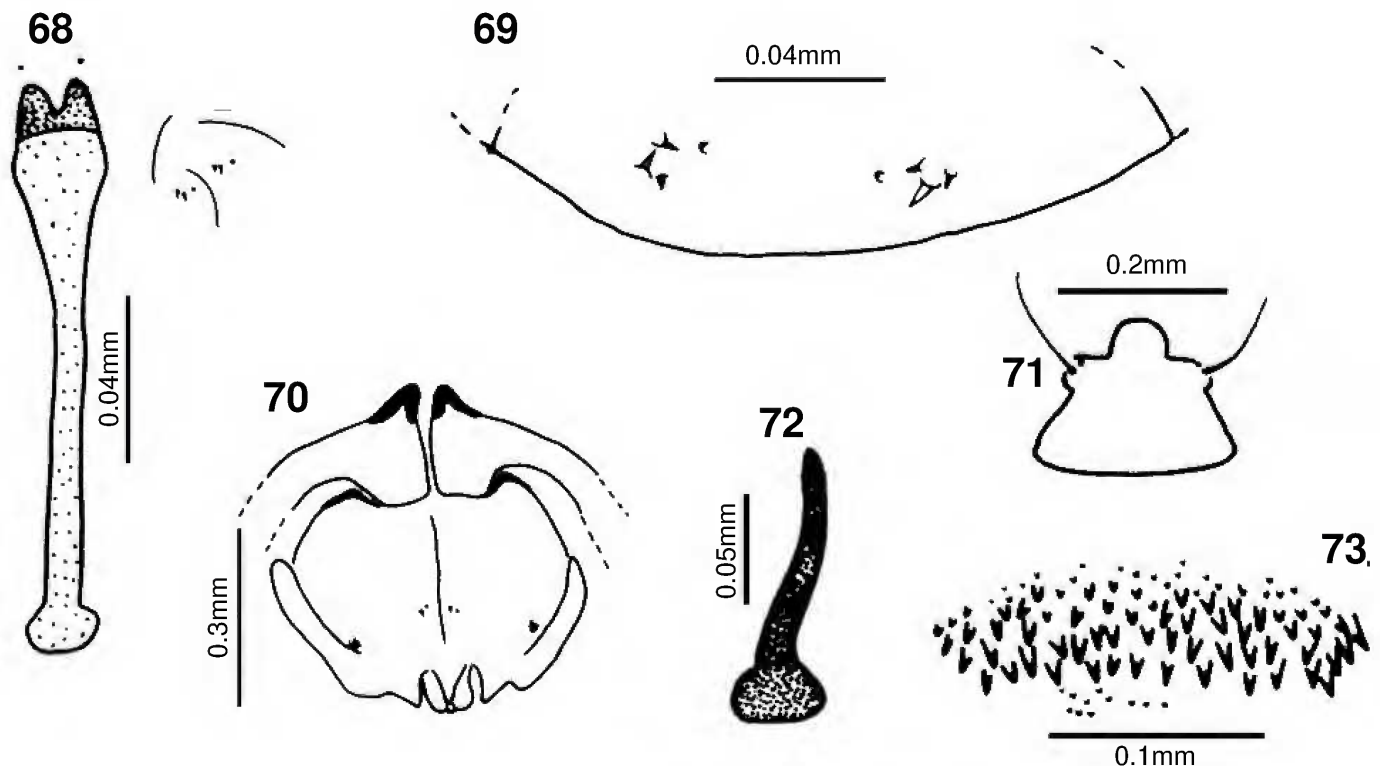
*Contarinia gemmae* Maia, sp. nov.  
(Figs.68-83b)

**Larva** – Body length: 1.7mm (N=1). Color: yellow. Spatula 2-toothed; length: 0.14mm (N=1); full complement of lateral papillae (Fig.68). Terminal papillae as in figure 69.

**Pupa** – Length: 2.8-3.0mm (N=4). Cephalic region (Fig.70): Antennal horn simple, triangular, with 0.04-0.05mm of length (N=4); full complement of lower and lateral papillae; upper cephalic margin thickened laterally; cephalic seta with 0.16-0.18mm of length (N=4) (Fig.71). Thorax: Prothoracic spiracle well developed, elongate, setiform (length: 0.13-0.15mm) (Fig.72). Wing sheath reaching the distal margin of the abdominal segment 3; fore leg reaching  $\frac{1}{2}$  of the abdominal segment 6;

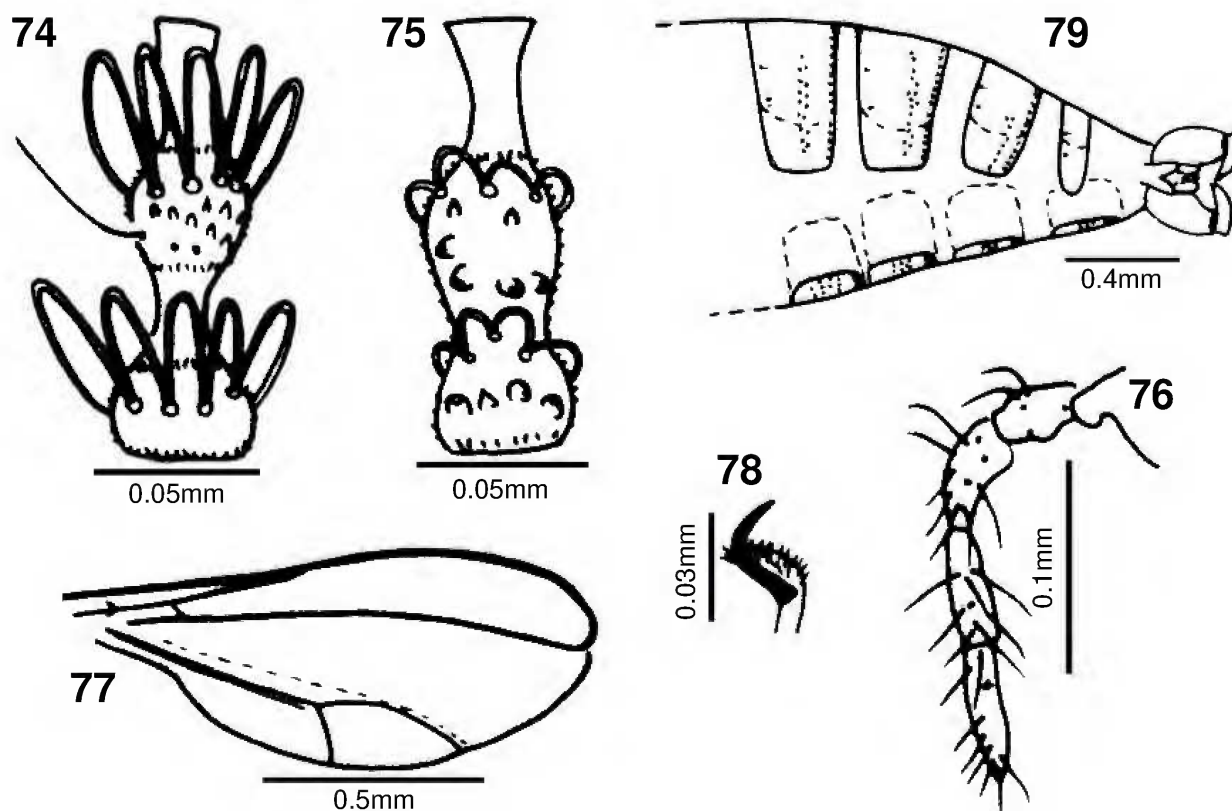
mid leg reaching  $\frac{1}{3}$  distal of the abdominal segment 6; hind leg reaching  $\frac{1}{3}$  basal of the abdominal segment 7. Abdomen (Fig.73): Tergites 2-8 with 4 irregular rows of small spines and elsewhere with spinules.

**Adult** – Length: 2.5-2.7mm (N=4) (female: measured from head to abdominal segment 8). Head: eyes facets hexagonal, all equally closely approximated. Postvertical peak present. Antenna: male flagellomeres binodal and bicircumfilar (Fig.74). Female flagellomeres cylindrical, circumfilar as in figure 75. Flagellomere 1 and 2 connate, flagellomere necks without setulose, twelfth flagellomere without apical process in both sexes. Frontoclypeus with 8 setae. Labrum triangular, long-attenuate, with 2 pairs of ventral sensory setae and long, anteriorly directed lateral setulae. Hypopharynx of the same shape as labrum with long, anteriorly directed lateral setulae. Labella elongate and setose. Palpus: all segments cylindrical, the first the shortest, the second the widest, the third and fourth subequal in length, narrower and longer than the preceding ones (Fig.76). Thorax. Wing (Fig.77): length: 1.8-2.2mm (N=4). Anepisternum



*Contarinia gemmae* Maia, sp. nov.: fig.68- larva, spatula prothoracic and associated papillae (ventral); fig.69- larva, terminal segments (dorsal); fig.70- pupa, cephalic region (ventral); fig.71- pupa, cephalic setae; fig.72- pupa, prothoracic spiracle (dorsal); fig.73- pupa, abdominal segment VI (dorsal).





*Contarinia gemmae* Maia, sp.nov.: fig.74- male flagellomere V; fig.75- female flagellomere V; fig.76- ♂, palpus; fig.77- ♀, wing; fig.78- ♂, tarsal claw and empodium, foreleg; fig.79- ♂, abdominal segments 5 to the end (lateral).

bare. Anepimeron with vertical irregular row of 12 setae. Tarsal claws bent beyond midlength, simple on all legs; empodia reaching to bend in claws (Fig.78).

Abdomen. Male (Fig.79): tergites 1-7 rectangular with single, continuous, posterior row of setae, several lateral setae on each side near midlength, covered with scales and pair of trichoid sensilla on anterior margin. Tergite 8 narrower than the preceding ones with pair of trichoid sensilla. Sternites 2-7 rectangular and setose, setae more abundant basally and mesaly and 2 trichoid sensilla. Female (Fig.80): tergites 1-7 as for 1-7 in male; sternites 2-7 as for 2-7 in male; tergite 8 sclerotized with a reentrance at the anterior margin, 1 pair of trichoid sensilla and few setae. Sternite 9 with scattered setae. Male terminalia (Fig.81): gonocoxites not splayed, without mesobasal lobes; gonostylus with setulae at the base and striae elsewhere; cercus rounded and setose; hypoproct bilobed (lobes thin and splayed); parameres absent; aedeagus elongate and tapering gradually to apex. Ovipositor very protrusible, female cerci

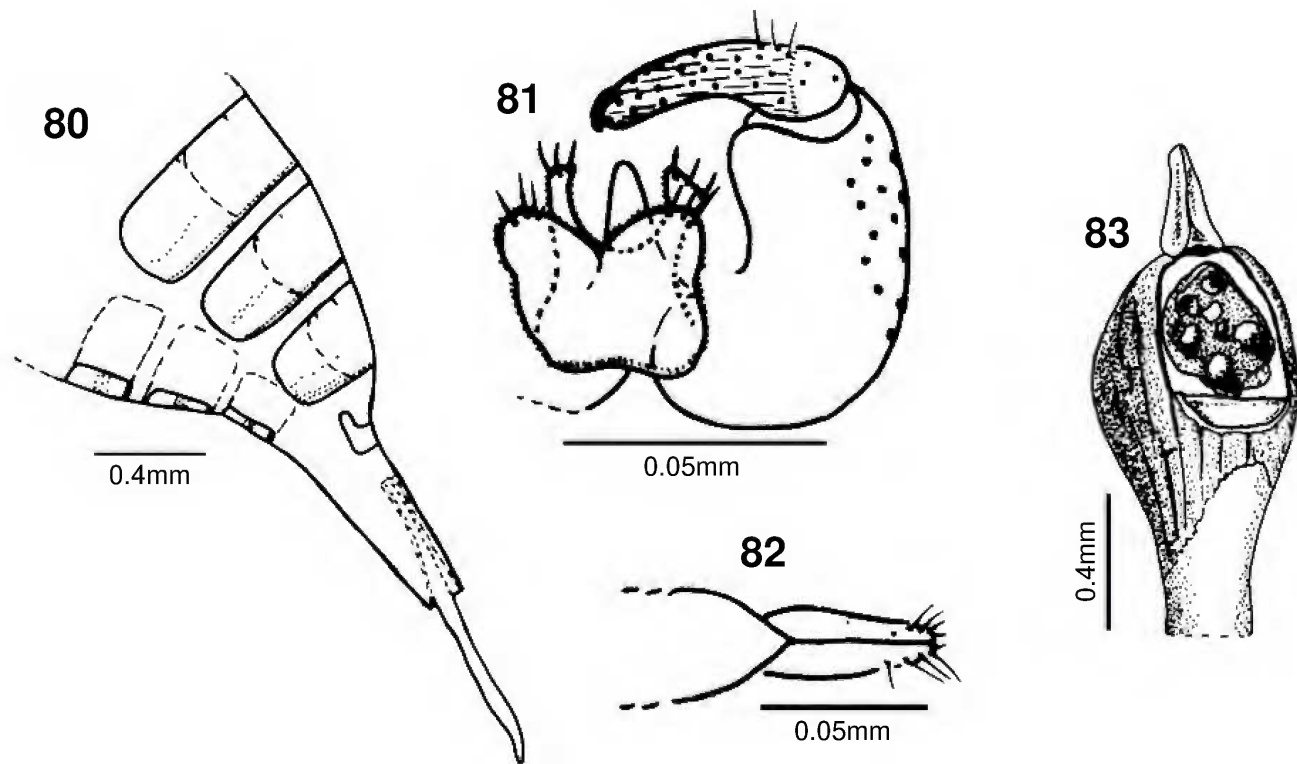
long-attenuate, without microtrichia, with scattered setae and each with 1 pair of apical basiconic sensilla (Fig.82).

Material (MNRJ) – Holotype ♂ BRAZIL, RIO DE JANEIRO: Carapebus, 06/VI/2000, emg. 26/VI/2000, J.Madeira col. Paratypes: 1♂ and 2♀ (same locality, date and collector as holotype); 1♀, 23/XI/2000, emg. 14/XII/2000; 1 larva, 29/XII/2000, fix. 17/I/2001; 11 pupal exuviae, 29/XII/2000, emg. 17/I/2001; 4♂, 29/XII/2000, emg. 1 on 15/I/2001, 2 on 17/I/2001 and 1 on 18/I/2001; 3♀, 29/XII/2000, emg. 17/I/2001; 2♀, 09/VII/1999; 1♀, 21/VII/1999; 1♀, 04/VII/2000; 2 pupal exuviae, 21/VII/1999; 1 pupal exuviae, 27/V/2001, fix. 07/VI/2001 (same locality and collector as holotype).

Gall (Fig.83a, b) – Stem bud gall varied in size according to its variable number of chambers (from one to eight). When one-chambered it is hardly visible, but when multi-chambered it forms a spheroid swelling easily identifiable.

Adults were obtained from galls collected on June/July and november/December. It was





*Contarinia gemmae* Maia, sp.nov.: fig.80- ♀ , abdominal segments 5 to the end (lateral); fig.81- male terminalia (dorsal); fig.82- ♀ , cerci (ventral); fig.83- transversal section.

TABLE 1

Ecological information about the galling species associated with *Calophyllum brasiliense*

Species	Chambers per gall	Sex ratio (% ♀)	N (adults)	Galls per leaf				N (leaves)
				Mean ± S.E.	Min	Max	Mode	
<i>Lopesia caulinaris</i> Maia sp.nov.	1	54.6	17	Stem gall	-	-	-	-
<i>Lopesia conspicua</i> Maia sp.nov.	1	47.4	165	3.23 ± 0.14	1	24	1	525
<i>Lopesia elliptica</i> Maia sp.nov.	1	55.6	9	2.02 ± 0.08	1	10	1	387
<i>Lopesia linearis</i> Maia sp.nov.	1	54.6	22	7.51 ± 0.28	1	117	1	1377
<i>Contarinia gemmae</i> Maia sp.nov.	1-8	46.7	44	Stem gall	-	-	-	-

observed attacking plants of all heights, except those shorter than 1.3m.

This is the only galler on *C. brasiliense* out of the genus *Lopesia*.

Etymology – The name *gemmae* refers to the gall placement on the host plant.

Remarks – *C. gemmae* is the unique species of the genus that is associated with Clusiaceae.

Table 1 summarizes ecological information about galler species associated with *Calophyllum brasiliense*.

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